Ethics in Neuroscience Graduate Training Programs: Views and Models from Canada

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ABSTRACT—Consideration of the ethical, social, and policy implications of research has become increasingly important to scientists and scholars whose work focuses on brain and mind, but limited empirical data exist on the education in ethics available to them. We examined the current landscape of ethics training in neuroscience programs, beginning with the Canadian context specifically, to elucidate the perceived needs of mentors and trainees and offer recommendations for resource development to meet those needs. We surveyed neuroscientists at all training levels and interviewed directors of neuroscience programs and training grants. A total of 88% of survey respondents reported general interest in ethics, and 96% indicated a desire for more ethics content as it applies to brain research and clinical translation. Expert interviews revealed formal ethics education in over half of programs and in 90% of grants-based programs. Lack of time, resources, and expertise, however, are major barriers to expanding ethics content in neuroscience education. We conclude with an initial set of recommendations to address these barriers which includes the development of flexible, tailored ethics education tools, increased financial support for ethics training, and strategies for fostering collaboration between ethics experts, neuroscience program directors, and funding agencies.

INTRODUCTION

Advances in modern neuroscience have come rapidly and, with them, new and significant ethics challenges. Recognizing the importance of these challenges, scientists and scholars whose work focuses on mind and brain have begun to turn their attention to the ethical and social responsibilities that accompany modern innovation. New applications of neurotechnology such as for marketing research (Murphy, Illes, & Reiner, 2008), the use of neuropharmaceuticals for enhancing brain function (Greely et al., 2008), implications of understanding the neurobiology of mind phenomena such as decision making and moral responsibility (Greene, Nystrom, Engell, Darley, & Cohen, 2004), and the role that media plays in public literacy about science, the successes, and the tensions that neuromyths have created (Illes et al., 2010; Racine, Bar-Ilan, & Illes, 2005; Racine, Amaram, Seidler, Karczewska, & Illes, 2008) are some of the most compelling examples of these responsibilities.

Scholars from around the globe have called for the adoption of such neuroethics content in neuroscience programs (Conti & Corbellini, 2008; Sahakian & Morein-Zamir, 2009). Indeed, this call encompasses education about research ethics issues that are unique to study of the brain. These include challenges, for example, of recruiting and consenting people who suffer from mental health disorders that may affect their vulnerability in research and compromise decision making. They include challenges of managing unexpected clinical anomalies in brain research that may or may not be medically significant (Illes et al., 2006; Wolf et al., 2008). They include profound questions about the use of new neurotechnology to predict diseases of the brain in people who are currently healthy and for whom the future rampages of loss of memory and executive function associated with Alzheimers or frontotemporal dementia, for example, will be inevitable in the continuing absence of a cure.

The call also encompasses education about neurotechnology and the ever-expanding understanding of moral behavior it enables: studies that increasingly reveal new biological information, through brain imaging for example, about how people think, reason, and make decisions and that fundamentally may have an impact on personal identity, brain privacy, and even belief systems and spirituality (Roskies,

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2002). These studies have particular significance as they address the personal, philosophical, and religious salience of mind and body that may lead to new definitions of normal behavior and challenge notions of personhood and authenticity. They also increasingly bring new information about moral agency, empathy, and responsibility out of the laboratory and into the criminal justice and health policy domains, with wide application, for example, to the understanding and management of addiction disorders, psychopathy, deviant adolescent behavior, and other human phenomena that compromise a person's ability to act morally and socially in the world.

The training agenda for neuroscience, however, is already heavily laden. Our goal here was to examine the current landscape of biomedical ethics education—"ethics" as a shorthand—on the Canadian neuroscience training landscape as a first starting point and to elucidate the perceived needs and priorities of those mentoring and training in the neurosciences. This approach allowed us to examine two existing and well-defined programmatic structures—institutional and grant funded that are models for similar programs worldwide—operating within a single national health care system. We conclude with recommendations for resource development to meet local needs as interpreted for the Canadian context, with the goals of seeding further research on ethics education in the domain of neuroscience, including outcome measures of innovative programs, and translating the results internationally.

METHOD

We used two approaches for data collection: surveys and expert interviews.

Survey

We designed a three-part, 13-question survey (adapted from Conti & Corbellini, 2008) that used both binary and continuous scale questions to probe for: (a) general interest in neuroethics; (b) ethics education, resources, and dialogue; and (c) ethics concerns. We vetted and piloted the survey with local experts in both the neurosciences and ethics communities and finalized it based on their feedback. Surveys were distributed in hardcopy and data collected at the Second Annual Meeting of the Canadian Association for Neuroscience (CAN) in Montreal, QC (May, 2008). Data were analyzed using EpiInfo. The study was conducted under the University of British Columbia's Research Ethics Board approval.

Interviews

We designed a four-part, 25-question interview guide to obtain: (a) the scope of ethics training in existing curricula, (b) priorities for ethics training, (c) views on new kinds of ethics material, and (d) background information on the program. The interview guide was developed in collaboration with members of the Canadian Institutes of Health Research-Institute for Neuroscience, Mental Health and Addiction (CIHR-INMHA), CIHR Ethics Office, and other experts. The purpose of the interviews was to gain more in-depth information from experts about ethics in neuroscience training programs. Participants were asked closed questions with specific choices and open questions that encouraged narrative responses.

Neuroscience program directors and principal investigators (PIs) holding Canadian Institutes of Health Research-Strategic Training Initiative in Health Research (CIHR-STIHR) training grants (training grant PIs) were invited to participate, describe their programs, and provide their expert opinions. Participants were identified using the Neuroscience Canada database (www.neurosciencecanada.ca), the Association of Neuroscience Departments and Programs (ANDP; www.andp.org) Web site and the CIHR-STIHR grantee database. All individuals identified were contacted via e-mail and asked to respond with their availability for a 20-min phone interview, which was transcribed and analyzed in Excel.

RESULTS

Survey

We received 201 completed surveys. Eight were excluded because respondents were neither educated in Canada nor currently working in Canada. Our final cohort for analysis ($N = 193$) represents 17% of the total number of the CAN conference attendees ($N = 1{,}143$). The gender breakdown was roughly 50–50% and the majority of respondents were from Canada's most populous provinces—Quebec and Ontario (see Table S1 in Supporting Information for additional respondent demographics).

A total of 88% of respondents reported having a general interest in neuroethics. Specifically, 58% of respondents reported that they were very interested or interested in more opportunities to engage in the subject. Thirty-eight percent were slightly interested and 3% were not interested in neuroethics. Thirty-eight percent also indicated that they had not received any prior ethics training. Of those who did have some exposure to ethics, undergraduate and graduate courses were the major sources of training (see Figure 1).

Journal articles, conferences, seminars, and Web sites were reported to be the primary current source of ethics information. Forty-six percent of responders reported that their institution had a bioethics or biomedical ethics program or center; 53% were unsure or did not know.

Misinterpretation or overinterpretation of results by the press or public were each cited by more than 35% of responders

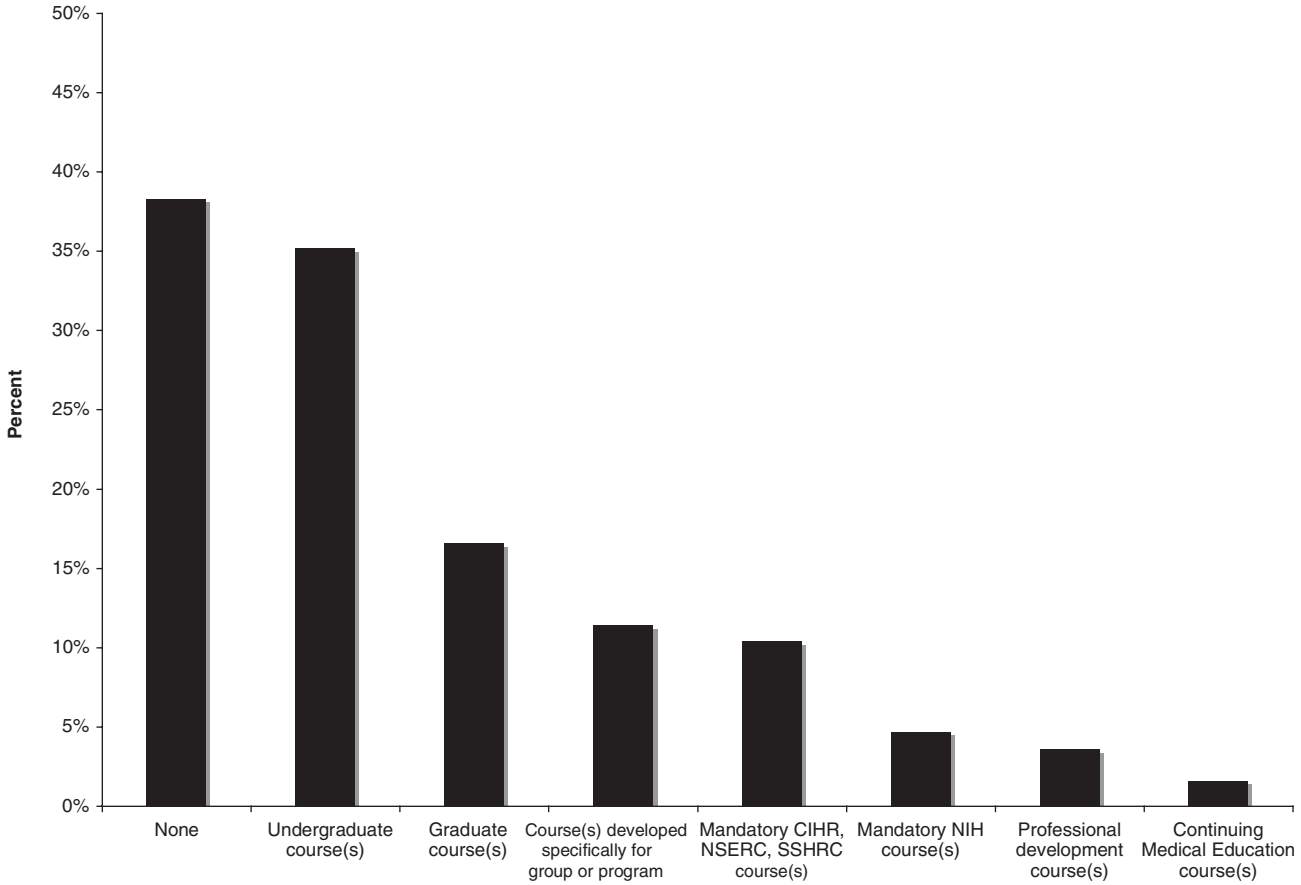

Fig. 1. Reported ethics training.

as ethics issues they dealt with on a regular basis. Conflict of interest and the challenges associated with conducting research on diseases for which cures do not exist were each cited as concerns by more than 20% of responders. Other issues received less than 20% of the responses. Given the opportunity to add comments on issues not offered a priori, responders most frequently cited animal research ethics, research with pediatric populations, and ethical issues related to publication most frequently.

Interviews

We received 13 responses from neuroscience program directors (59% response rate) and from 11 PIs (55% response rate) for a total of 24 interviews conducted between December 2008 and May 2009. Participants were from 16 institutions across Canada. Sixty-four percent belonged to interdisciplinary departments or centers (e.g., interdisciplinary program in neuroscience), 29% to psychology departments, 8% to departments of medicine, and 4% to biological science departments. A total of 79% of the programs had more than 15 faculty members; 100% of the neuroscience programs and 46% of the grant-based training programs had 20 students or more enrolled (see Table S2 in Supporting Information for areas covered by the programs).

We found differences in the percent of neuroscience programs compared with the grant-based training programs offering formal ethics (62 and 91%, respectively), and for interest to include more ethics content in the curriculum (54 and 73%, respectively). By contrast, more than 90% of the program directors and 100% of the PIs described the importance of including ethics training in these programs.

Neuroscience program directors emphasized external motivators (regulatory environment, institutional encouragement, public perception, and professional advancement; 58% of responses) over internal motivators (interest from students and faculty, and good citizenship; 42% of responses). PIs selected internal motivators (59%) more often than external ones (41%). Motivators and barriers for including ethics in curricula are shown in Figure 2.

Priorities for ethics content are human subject research ethics (85% program directors; 82% PIs), animal research ethics (77% program directors; 91% PIs), and neuroscience research ethics material (69% program directors; 82% PIs). Case studies are preferred (see Table 1).

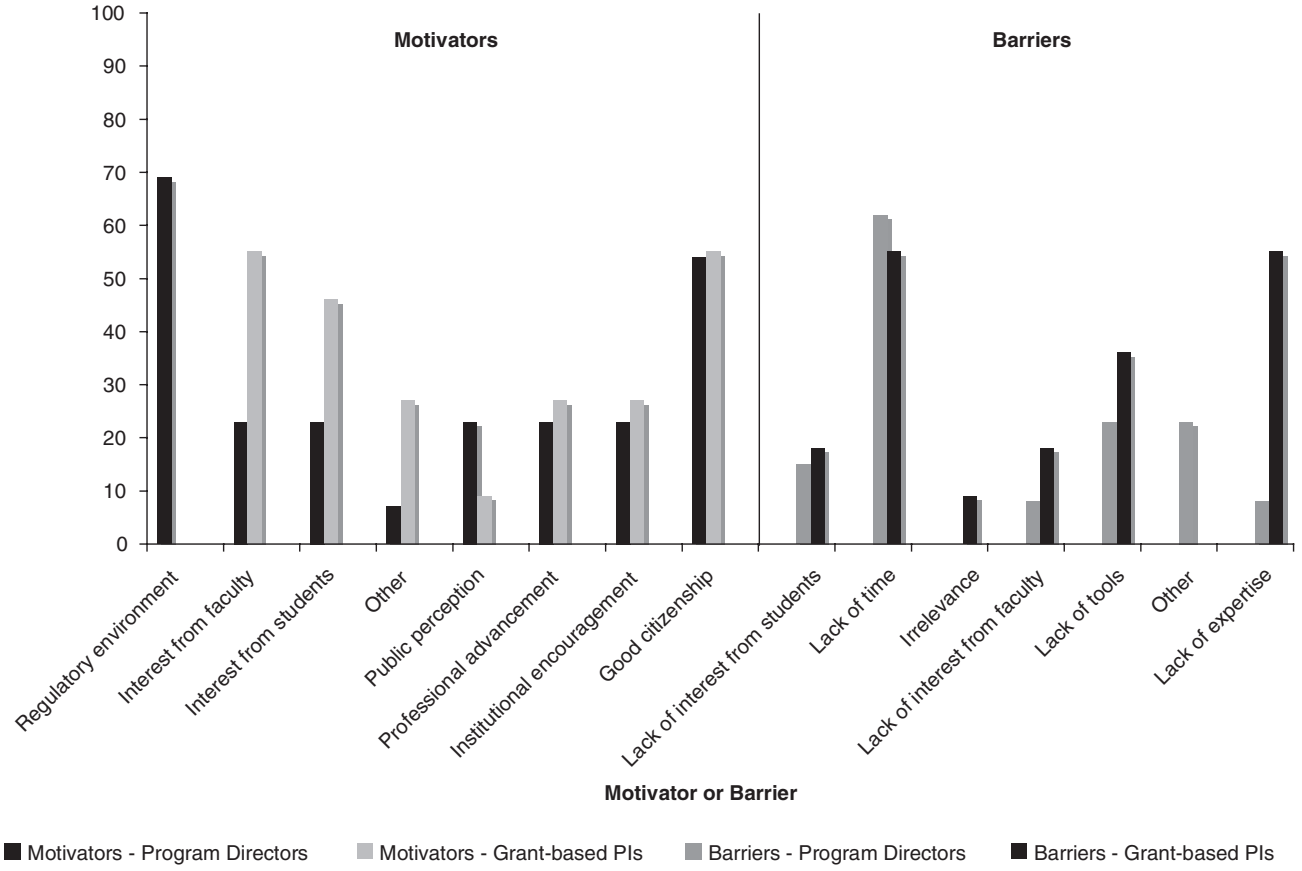

Fig. 2. Motivators and barriers for including ethics in neuroscience training programs (responses from program directors and principal investigators [PIs]).

DISCUSSION

From concepts in biomedical ethics prescribing good research conduct, such as informed consent and equipoise, to ethical challenges in application, such as those surrounding new abilities to probe the functional metabolic basis of thought and morality, our findings suggest that interest in these topics is high among neuroscientists in Canada. However, there is a reported lack of educational opportunity to learn about, understand, and address associated challenges. The needs and interests of the community are not being met.

Both survey respondents and interviewees reported having interest in more opportunities to integrate ethics into their professional and academic environment by increasing opportunities to discuss ethics and by incorporating more ethics content into curricula. Some survey respondents reported a general dissatisfaction with current approaches to ethics saying, for example, that "[ethics concerns are] never discussed amongst colleagues—not good. We all should be obliged to take part in neuroethical discussions." Both cohorts of directors emphasized the importance of understanding and discussing ethics-related topics with other members of the neuroscience community (e.g., in laboratories and conferences and with members of the public). Respondents overwhelmingly stressed that for resources to be useful they should be tailored to brain research and the research focus of individual programs.

An in-house follow-up analysis showed that there is a bioethics center at 12 of the 17 institutions represented by survey responders who reported no knowledge of one on or associated with their campus. With more than 95% of respondents indicating interest in opportunities for neuroethics discussion, we conclude that regular informal communication would be welcome and propose that formal collaboration could be a new goal.

We perceived the report from survey responders about a lack of ethics training to be surprising, given the requirement that all students, fellows, and PIs who conduct research involving human subjects or animal models to complete a training course, whether it is the Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans tutorial, the Canadian Council on Animal Care Institutional Animal User Training program, or similar programs. One possible explanation for the limited ethics training reported is that the

Table 1
Current and Future Training Format; Structure for Integrating Ethics into Curricula

	Program directors (%)	*Grant-based PIs (%)*
Current ethics training format		
Stand-alone course	63	20
Course offered by outside organizational unit	50	20
Workshop	25	50
Lecture within a course	0	30
Module within a course	13	30
Seminar series	0	20
Small group discussion	13	10
Other (e.g., on line elective course)	0	20
Preferred format for future educational ethics materials		
Case studies	46	55
Bibliographic and policy information	31	9
Full lecture material	23	36
Stand-alone online material	23	46
Other: video material, textbook	23	9
Preferred structure for integrating ethics into the training curriculum		
Mandatory course	31	18
Day-long workshop	31	27
Freely accessible online resources	23	18
Integrating ethics into existing courses	15	64
Elective courses dedicated to ethics	8	27
Seminar series	0	46
Required PI-led group discussions	0	9
Other: Hands-on tutorials with REB applications, Web-cast lectures, informal dialogue	23	27

PI = principal investigator; REB = Research Ethics Board.

tutorials are viewed more as tests or assessments of knowledge rather than as training tools. Moreover, existing approaches to ethics education in neuroscience programs are not uniform across universities or programs in Canada. This discrepancy between the time allocated to ethics training between the neuroscience programs and grant-based training programs can be explained by the CIHR requirement for all STIHR curricula to include an ethics component.

Neuroscience program directors emphasized forces external to the neuroscience program (such as the regulatory environment and institutional encouragement) more than internal factors (such as interest from students and faculty) as motivators for including ethics in their curricula. By contrast, training grant PIs cited interest from faculty and good citizenship, both internal motivators, as the major reasons for enhancing ethics curricula. Federal requirements to include ethics in grants-based training curricula may therefore serve as a true incentive rather than just a requirement toward acceptance and perceived value.

Both program directors and PIs identified lack of time and educational resources, including experts to teach, as barriers to achieving more ethics content in curricula. Some independent groups have made ethics material available online for students to access independently as needed, thereby providing information to students without detracting from class time.[1] Access to print or online resources, however important, is not equivalent to ethics dialogue (Fins, Bacchetta, & Miller, 2003).

On the basis of the data collected via surveys and interviews we have developed a set of recommendations to address the three main barriers to ethics education in neuroscience programs—lack of resources, expertise, and time—focused on the three key stakeholder groups at the intersection of ethics and neuroscience—neuroethics leaders, neuroscience leaders, and funders. The recommendations are described in detail below and summarized in Table 2.

Education tools and resources

To address the reported lack of ethics education tools, resources especially in the form of case-based materials that are tailored to brain research are needed for face-to-face ethics training. Modules should complement existing activity and be fully integrated into training programs to maximize receptivity to them. On the basis of our data here and elsewhere, the first set of modules should cover:

1. fundamental principles and contemporary writings in bioethics, biomedical ethics (classic cases with a focus on the central nervous system), and neuroethics;
2. applied societal implications of neuroscience and planning for impact of results upstream during research design, using historical examples and current relevant literature;

Table 2
Recommendations for Ethics Training

Stakeholder group	*Recommendation*
To address the lack of internal resources	
Ethics collaborators	Develop new ethics tools and resources tailored to brain research to complement existing activity. Based on data presented here and elsewhere, the first set of modules should cover: 1. fundamental principles and contemporary writings in ethics 2. applied societal implications of neuroscience using case studies 3. translational considerations for clinical trials and other research 4. communication and dissemination of neuroscience to the press and public 5. commercialization challenges
Program directors, PIs, and educators	Seek out local resources and guide the development of the resources outlined above.
Funding agencies	Promote ethics in neuroscience through traditional mechanisms (required instruction hours) and creative ones (financial support for didactic ethics activities).
To address the lack of expertise	
Ethics collaborators	Create and support ethics training opportunities for neuroscience faculty members, fellows and students.
Program directors, PIs, and educators	Seek out local expertise and foster collaborations for educational and research purposes.
Funding agencies	Support neuroscience faculty training in ethics and foster visiting faculty programs.
To address the lack of time	
Ethics collaborators	Develop training materials that can be easily customized and tailored.
Program directors, PIs, and educators	Explore optimum structure for integrating new ethics modules into training programs.
Funding agencies	Create incentives for programs to include ethics.

3. translational considerations for clinical trials and other research that moves neuroscience innovation from the bench to the bedside;
4. communication strategies and innovative approaches to disseminating neuroscience knowledge to the press and public; and
5. commercialization challenges.

These modules should be tested and refined as they are adopted in both traditional and interactive media contexts based on rigorous measures of outcome.

Collaboration among ethics experts and neuroscience program directors and PIs to ensure relevant and appropriate content and format is also critical for the development of the modules. Sponsors of training programs can foster such collaborations through traditional funding mechanisms—for example, required multidisciplinary instruction hours—and creative ones—for example, financial support for didactic ethics activities and collaborative research on education. Both regular and ad hoc grant opportunities will be necessary for these initiatives.

Expertise

To address the second major barrier, lack of expertise, we suggest creating training and funding opportunities for neuroscience faculty to gain expertise in ethics. We propose mechanisms to support visiting faculty from the humanities to neuroscience programs and neuroscientist stays in ethics programs. Such faculty exchanges will foster new dialogue among the groups and in the neuroscience domain in particular, provide "on the ground" support as ethics programs are implemented. Overall, narrowing the existing gap in information about local resources and expertise through interdisciplinary collaborations will allow neuroscience programs to capitalize on existing tools and develop new ones.

Lack of time

Lack of time for ethics training was reported as the third major barrier, yet subjects' recommendations for how to address it were limited. Developing training materials that can be easily customized to meet the needs and focus of different programs (e.g., imaging, pediatric) and exploring faculty and student preferences for ethics material will help ensure that all material is relevant. Because there was little agreement as to the preferred format for ethics training, we suggest exploring various structures for integrating modules into programs. The first step is to investigate existing curriculum structure and design ethics modules to best suit programs (e.g., in series across time or as a dedicated unit). Feedback on and evaluation of the first generation of ethics training programs should be sought and programs continuously updated based on the data gathered.

The recommendations outlined here are the first attempt to address the barriers reported by our student and expert informants, with the goal of ensuring that ethics education

becomes a core and well-integrated part of neuroscience education. The short-term successes of implementing these preliminary recommendations will be demonstrated by the genuine interest, ability, and confidence of stakeholders to respond to immediate issues; in the longer term, new curricula will equip stakeholders to anticipate and participate in debates to come. On either temporal horizon, the increased willingness of neuroscientists to think proactively about the direct implications of their work on people and societies, empowered by flexible tools to which they are fundamentally receptive, will be the ultimate positive outcome.

To this end, implementing and refining the initial recommendations proposed here will require a coordinated and collaborative effort by ethics collaborators, program directors, PIs, and funding agencies.

LIMITATIONS

Our sample represented neuroscientists across Canada. Generalizability of the findings is limited by this sampling strategy and response rate. Graduate students constituted a disproportionate number of survey responders. The data may also overrepresent neuroscientists interested in ethics, as those not interested would be less likely to participate in the study. We also only spoke with slightly more than half of the Canadian leadership in neuroscience training.

CONCLUSION

Canadian neuroscientists, neuroscience program directors, and PIs reported an interest in ethics content related to the brain—broadly defined as neuroethics—and a desire to incorporate ethics into their professional and academic environment. Although ethics education is recognized as an important component of neuroscience graduate training programs, the degree to which trainees are exposed to the material varies. Because of a requirement to include ethics in their curricula, federally funded training programs include more extensive ethics material than university-based neuroscience programs. PIs identify internal factors such as motivators for ethics education rather than federal requirements. We believe that a culture shift in favor of ethics education has taken place among this cohort. Respecting the time constraints of already heavy training requirements and responding flexibly to the many reported ethics needs of neuroscientists with products that are relevant and practical will further promote such a shift toward fully integrated neuroethics.

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SUPPORTING INFORMATION

Additional Supporting Information may be found in the online version of this article:

Table S1. Professional level,[2] Highest degree earned, Research focus, Research area, Practice setting and funding sources of survey respondents. (Percentages may exceed 100 as respondents had the option to provide more than one answer per question)

Table S2. Research areas reported by neuroscience program directors and STIHR PIs

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NOTES

1 For example, the University of Toronto's Faculty of Medicine and the Faculty of Applied Science and Engineering have each developed a Web page dedicated to ethics in graduate research. These Web pages include presentations, case studies, and other materials on professional ethics, human subjects research ethics, conflict of interest, and intellectual property (http://www.facmed.utoronto.ca/programs/graduate/gradethics.htm and http://www.engineering.utoronto.ca/informationfor/graduate/ethics.htm).

2 Answer choices "full professor or equivalent," "associate professor or equivalent," "assistant professor or equivalent" were collapsed and renamed "faculty" for data analysis purposes. Answer choices "laboratory technologist" and "professional research staff" were collapsed and renamed "research staff" for data analysis purposes.

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